

REMARKS

Applicants have carefully reviewed the rejections raised in the Office Action dated January 19, 2011 and have amended the present application accordingly.

Remarks to Amendments

The majority of amendments in this response are to claim 1, for the purpose of more clearly reciting the invention. These will be discussed in the following text.

The first group of amendments is as follows:

"i) a single liquid crystal display modulator and ~~an array~~ a plurality of light emitting diode[[s]] clusters positioned in an array to backlight the liquid crystal display modulator, the ~~array of~~ light emitting diode[[s]] clusters each including at least one each of red, green and blue wavelength emitting light emitting ~~diodes with~~ diodes, with a ..."

This first group of amendments specifies that for each display module there is a single liquid crystal display modulator, and changes the wording from an "array of LEDs" to a "plurality of LED clusters positioned in an array", each cluster including at least one red, green and blue LED. This amendment is made to specify more clearly that there are a plurality of light sources of each color lighting a single liquid crystal display modulator, and that each module does not comprise multiple liquid crystal display modulators. This group of claim amendments is supported in many places in the application, for example, in Figures 2, 3 and 4, and in the detailed description section, as follows:

*“A display module has been constructed comprising **seventy-two (72) LEDs (24 red, 24 green, 24 blue)** arranged as shown...Each **cluster of three neighbouring LEDs...**”* (p. 7 l. 1-10)

Thus, Applicant respectfully submits that these changes are fully supported in the specification as originally filed and do not constitute the addition of new matter.

The second group of amendments is also found in claim 1, and is as follows:
“a beam of light from each light emitting diode being focu[[s]]sed onto a pre-selected region of the liquid crystal display modulator spaced from the light emitted by the other light emitting diodes, each pre-selected region of the liquid crystal display modulator including ~~an array~~ a set of optical modulation elements ...”

The first amendment in this group is simply a spelling correction from “focussed” to “focused”, and similar such amendments are found in claim 4. Applicant respectfully submits that all of these amendments are simply spelling corrections and were made to further clarify the claims.

The next amendment consists of changing the “array” of optical modulation elements to a “set” of optical modulation elements. This amendment was made to make the language in the claims consistent; as seen further down in claim 1, the word “set” replaced the word “array” for all future use:

*“control means connected to each individual modulation element of **each set of optical modulation elements** for controlling...”* (claim 1)

Thus, Applicant respectfully submits that this amendment was made to more clearly recite the invention, is fully supported in the original set of claims as filed and does not constitute the addition of new matter.

Remarks to Claim Rejections – 35 USC Section 103(a)

The Examiner has rejected claims 1-5 under 35 U.S.C. 103(a) for being unpatentable over U.S. Patent No. 5,053,765 to Sonehara et al. (*Sonehara*) in view of U.S. Patent No. 6,224,216 to Parker et al. (*Parker*) and further in view of U.S. Patent No. 5,293,437 to Nixon (*Nixon*).

The Examiner is directed to claim 1, which comprises the following two limitations:

- 1) Each display module comprises a **single** liquid crystal display modulator and a **plurality** of light emitting diode **clusters** ... each including at least one each of red, green and blue wavelength emitting light emitting diodes
- 2) a beam of light from each light emitting diode being focused onto a pre-selected region of the liquid crystal display modulator spaced from the light emitted by the other light emitting diodes

These two limitations combined result in a device structure wherein the red, green and blue LEDs are each responsible for providing a light source for a portion of, but not the entirety of, a single LCD modulator. Applicant respectfully notes that the devices disclosed in *Nixon*, *Sonehara*, and *Parker* all do not contain this feature. Specifically, the closest device shown in *Sonehara* (i.e. one which does not contain a light color filter) to the device in the present application is shown in Figure 29 as noted by the Examiner in the Office Action. However, the red, green and blue light sources in this device each illuminate the entirety of a color-dedicated light modulator; therefore,

three separate light modulators are required. In contrast to this, claim 1 recites the use of a single liquid crystal display modulator, a plurality of light emitting diode clusters (each cluster having multiple colours), and a beam of light from each light emitting diode being focused onto a pre-selected region of the liquid crystal display modulator spaced from the light emitted by the other light emitting diodes. In contrast to *Sonehara*, but no more similarly to the presently claimed invention, the disclosure in *Nixon* only teaches devices which have **one triplet of LEDs per pixel, where each LED illuminates just one optical fiber**. For instance, *Nixon* states that “each of the LEDs is disposed beneath the surface of one of the optical fibers on the end opposite to the optical fiber end such that they directly drive each of the optical fibers” (col. 2, l. 68 – col. 3, l. 4). *Nixon* does not teach the use of light modulators *or* the use of a single LED illuminating multiple optical fibers. Finally, *Parker* teaches arrays of LEDs whose light is passed through an “optical integrator [which] serves to homogenize the light from [the] plurality of LEDs or LED arrays” (col. 6 l. 55-57). In this manner, each color group of LEDs act as one homogenous color source similar to that found in *Sonehara*; *that is to say*, **each LED contributes to the light illuminating the entire LCD modulator**, rather than lighting individual portions of a single liquid crystal display modulator as is claimed in the present application.

Further, in the Office Action, the Examiner notes that “*Sonehara* fails to expressly teach an array of light emitting diodes positioned to backlight the liquid crystal display modulator, the array of light emitting diodes including at least one each of red, green and blue wavelength emitting light emitting diodes” (p. 7) and so relies on *Parker* for the teaching of the array of diodes. Claim 1 of the present application currently recites “a

plurality of light emitting diode **clusters** positioned in an array”; this is only found in *Parker* in the embodiment shown in Figures 3-4, as all other embodiments in *Parker* having LEDs teach grouping the colours together and homogenizing the light to effectively form 3 color sources prior to modulation (for example see Figure 9 with light from red, green and blue LEDs (70r, 70g, 70b) homogenized by optical integrators (40r, 40g, 40b) prior to modulation) or homogenizing the light to form white light prior to modulation (for example see Figure 8). However, in this embodiment, “the ends of optical fibers ... are mated to LEDs in a one-to-one relationship” (col. 5 l. 11-14). This embodiment constitutes the same teaching to one skilled in the art as the lighting configuration in *Nixon* (as seen in Figures 7, 7a, and col. 4 l. 39-48), which also teaches an array of LED clusters where each LED provides light to just one optical fiber (i.e., a one-to-one relationship). Thus, the only feature relevant to the present invention found in *Parker* which the Examiner relies on is also found in *Nixon*, and Applicant therefore considers the combination of *Sonehara*, *Parker*, and *Nixon* equivalent to the combination of just *Sonehara* and *Nixon*.

In view of this observation, Applicant respectfully submits that the combination of *Nixon* and *Sonehara* would not be obvious to one skilled in the art, and in fact would yield a nonfunctional display screen. If one were to provide the light source in *Nixon* (or *Parker*) with the LCD modulators, light guides and display screen of *Sonehara*, the device would not function correctly. The device shown in Figure 29 of *Sonehara* relies on the fact that there is **only one color of light on each LCD modulator**, while the light source of *Nixon* comprises an array of LED clusters each providing three colours of light. Thus, Applicant respectfully submits that the combination of *Nixon* and *Sonehara*

would require inventive effort by one skilled in the art to yield the device as claimed in the present application, and as such, the claimed device is patentable over these three references under 35 U.S.C. 103(a).

Further, it would not be obvious to replace the LCD modulators found in *Parker* or *Sonehara* with a single modulator. In column 9 lines 20 to 33, *Sonehara* specifically contends that a plurality of LCDs is preferable to a single LCD, and thus *Sonehara* teaches away from the single LCD of claim 1 of the present application. The justification for the position in *Sonehara* in column 9 lines 20 to 33 further would further deter one skilled in the art from attempting to use the single LCD as recited in claim 1. Therefore, because one skilled in the art would be driven away from a single LCD modulator by the perceived difficulties caused by this configuration, and because this feature yields a surprising advantageous result, it is non-obvious to one skilled in the art. Further, the implementation of it requires inventive effort, as discussed in the foregoing. Thus, Applicant respectfully submits that the claimed device is patentable over the references set forth by the Examiner under 35 U.S.C. 103(a).

Applicant respectfully notes that, as now embodied in the claims, the present invention has a number of advantages over the devices disclosed in *Nixon*, *Sonehara*, and *Parker*. The apparatus disclosed in the present application uses a combination of light sources and a single liquid crystal display modulator to create a more efficient, more scalable and easier to maintain display screen module than those found in the prior art.

In the present invention, because we teach using a single light modulator for multiple colours of light, the number of light modulators may be reduced compared to

Sonehara. Since each light modulator generally requires associated electronic connections, electronic drive and control circuitry, and mechanical mounting means, our invention can reduce the cost, the size and the complexity of the display compared to *Sonehara*. In addition, having more than one colour of light on one modulator inherently allows the use of shorter optical fibers than if multiple modulators are required with their associated electronic connections, electronic drive and control circuitry, and mechanical mounting means.

Some devices found in the prior art, such as those described in *Nixon*, require one light source per pixel to create displays. Again, due to the high number of light sources involved maintaining such displays is difficult and costly, and as these devices get larger they become more and more impractical. Finally, the devices disclosed in *Parker* are hard to compare to the present invention in this respect, as they are fundamentally projection devices and do not contain many of the structural elements of the present apparatus. However, there are intricate optical devices required in *Parker* such as the "...optical integrator, one or more optical path lenses, ... a projection lens group and various other optical components" (col. 4, l. 7-10) which are not necessary for inclusion in the devices disclosed in the present application.

Therefore, given that the apparatus detailed in claim 1 of the present application includes inventive structural features which are not found nor alluded to in any of the references set forth by the Examiner in the rejection alone or in combination, Applicant respectfully requests that the Examiner removes the rejection of claim 1 and dependent claims 2-5 under 35 U.S.C. 103(a). Applicant respectfully submits that the amendments have been made to more clearly and concisely recite the claimed invention.

Further, the Examiner has rejected claim 4 of the present application as being unpatentable over *Sonehara* in view of *Parker* and further in view of *Nixon*. This claim introduces the following limitations:

“the first ends of the plurality of optical fibers **being arranged symmetrically with respect to the beam of light** focused onto the pre-selected region of the liquid crystal display modulator so that light transmitted by each optical fiber **has substantially the same intensity**” (claim 4)

Specifically, in this rejection, the Examiner has cited Figure 29 and col. 18, l. 16-28 of *Sonehara*, and Figure 9 and col. 8, l. 13-23 of *Parker* in reciting the limitation of the “optical fibers being arranged symmetrically with respect to the beam of light...”; further, the Examiner has cited col. 9, l. 8-20 of *Sonehara* and col. 7 l. 47 – col. 8 l. 56 of *Parker* in reciting the limitation of “light transmitted by each optical fiber has substantially the same intensity”. Applicant respectfully disagrees that these citations recite the features of the present claim 4 that the Examiner has noted.

With respect to the symmetrical arrangement limitation, Figure 29 and col. 18, l. 16-28 of *Sonehara* discloses (in summary) an optic fiber bundle, a display surface, and three image input ends for receiving and mixing together the coloured light from three light sources. Each of the light sources provide one of red, green and blue light and can employ a polarization beam splitter or fiber-type light source. Figure 9 and col. 8, l. 13-23 of *Parker* discloses (in summary) a triple path projector employing three single colour LED arrays that propagate along separate paths through fiber bundles, light pipe integrators and display devices (preferably LCDs). The optical paths meet at a combiner which provides an image to lenses. Neither of these documents discusses the

positioning of optical fibers, particularly not optical fibers “**being arranged symmetrically** with respect to the beam of light focused onto the pre-selected region of the liquid crystal display modulator”.

With respect to the transmitted light intensity limitation, col. 9, l. 8-20 of *Sonehara* teaches that “if each subunit were illuminated by a different light source, variations in the light intensities between the plurality of light sources would create an image having a non-uniform intensity of light. Accordingly, a single light source illuminates the plurality of LCDs”. This does not disclose arranging illumination symmetrically to achieve substantially the same intensity of light travelling through the optical fibers, it discloses using one light source to achieve this effect. Furthermore, this teaches away from the present invention of using a plurality of light sources on a single LCD. Col. 7 l. 47 – col. 8 l. 56 of *Parker* discloses (in summary) “fiber bundles...to better homogenize the cumulative intensity of each wavelength of light at the entrance and exit of optical integrator”. This discloses combining light from a number of sources to effectively form a single light source; once again, this does not disclose the limitation of a symmetric arrangement of optical fibers with respect to a beam of light to achieve substantially the same intensity of light transmitting in the optical fibers.

Therefore, given that the apparatus detailed in claim 4 of the present application includes inventive structural features which are not found nor alluded to in any of the references set forth by the Examiner in the rejection alone or in combination, Applicant respectfully requests that the Examiner removes the rejection of claim 4 under 35 U.S.C. 103(a).

An earnest effort has been made to place this application in condition for allowance which action is respectfully solicited. Should the Examiner have any questions regarding the allowability of the claims with respect to the art, it would be appreciated if the Examiner would contact the undersigned attorney-of-record at the telephone number shown below for further expediting the prosecution of the application.

Respectfully Submitted,

/Ralph A Dowell/

Ralph A. Dowell
Reg. No. 26,868

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Dowell & Dowell, P.C.
103 Oronoco Street
Suite 220
Alexandria, VA 22314
(t) 703-739-9888
(f) 703-739-9889
e-mail: dowell@dowellpc.com